

Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) **EP 0 982 007 A3**

(12)

EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
31.01.2001 Bulletin 2001/05

(51) Int Cl.7: **A61B 17/70**

(43) Date of publication A2:
01.03.2000 Bulletin 2000/09

(21) Application number: **99306776.8**

(22) Date of filing: **26.08.1999**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE**
Designated Extension States:
AL LT LV MK RO SI

(72) Inventor: **Krag, Martin H.**
Colchester, Vermont 05446 (US)

(74) Representative: **Belcher, Simon James**
Urquhart-Dykes & Lord
Tower House
Merrion Way
Leeds LS2 8PA (GB)

(30) Priority: **27.08.1998 US 98071 P**
16.08.1999 US 375148

(71) Applicant: **DePuy Acromed, Inc.**
Raynham, MA 02767-0350 (US)

(54) **Spinal column retainer**

(57) A spinal column retainer including a rod for positioning along a spinal column, a fastener having a first portion for screwing into a portion of the spinal column and a second portion for receiving a nut, a retainer block including a passage for receiving the rod, a threaded passage for receiving a set screw, and a transverse passage, and an angular member extending between the retainer block and the fastener. The angular member

has an inner end portion captured within the retainer block, an outer end portion secured to the fastener, and a connecting portion between the end portions which forms an angular bend to offset the outer end portion from an axis of the inner end portion. The set screw forces the rod against the angular member which is forced against the retainer block, preventing movement of the components relative to one another.

EP 0 982 007 A3



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 30 6776

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
E	WO 00 42930 A (MULLANE THOMAS S) 27 July 2000 (2000-07-27) * abstract; figures 1,7,8 *	1,19,20	A61B17/70
X	WO 98 08454 A (JACKSON ROGER P) 5 March 1998 (1998-03-05) * page 35, line 19 - page 39, line 28; figures 17,21 *	1-6,19, 20	
X	EP 0 469 304 A (OLERUD SVEN) 5 February 1992 (1992-02-05) * the whole document *	1-5,11, 13,19,20	
X	EP 0 553 424 A (ACROMED CORP) 4 August 1993 (1993-08-04) * the whole document *	1-6,19, 20	
X	US 5 653 708 A (HOWLAND ROBERT S) 5 August 1997 (1997-08-05) * column 10, line 59 - column 12, line 38; figures 35-38 *	1-4,19, 20	
D,A	US 5 741 255 A (KRAG MARTIN H ET AL) 21 April 1998 (1998-04-21) * the whole document *	1-20	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.7) A61B
Place of search BERLIN		Date of completion of the search 8 December 2000	Examiner Hansen, S
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technical background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

EPO FORM 1503 03/82 (F04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 99 30 6776

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file or:
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

08-12-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0042930 A	27-07-2000	US 6050997 A	18-04-2000
WO 9808454 A	05-03-1998	AU 4089697 A	19-03-1998
EP 0469304 A	05-02-1992	JP 7008505 A	13-01-1995
		DE 69114597 D	21-12-1995
		US 5053034 A	01-10-1991
EP 0553424 A	04-08-1993	CA 2084130 A	31-07-1993
		CZ 9204010 A	11-08-1993
		HU 63548 A	28-09-1993
		JP 5269143 A	19-10-1993
		KR 9604979 B	18-04-1996
		ZA 9209472 A	10-06-1993
US 5653708 A	05-08-1997	CA 2103200 A	29-06-1994
		EP 0608623 A	03-08-1994
		JP 6218003 A	09-08-1994
		US 5545164 A	13-08-1996
US 5741255 A	21-04-1998	EP 0811356 A	10-12-1997
		JP 10043201 A	17-02-1998

EPO FORM PC459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to an apparatus for retaining portions of a spinal column, such as vertebrae, in a desired spatial relationship. Specifically, the present invention relates to retainers of the type disclosed in U.S. Patent No. 5,741,255, issued April 21, 1998, and in the prior art references cited therein, all of which are incorporated herein by reference.

SUMMARY OF THE INVENTION

[0002] The present invention provides an apparatus for retaining portions of a spinal column in a desired spatial relationship. The apparatus generally includes a threaded fastener which engages a portion of the spinal column and a longitudinal member or rod which is positioned along the spinal column at a location offset from the fastener. An angular member is connected between the fastener and the rod and extends for a first distance in a direction away from the rod and for a second distance in a direction at an angle relative to the first direction.

[0003] A retainer assembly is connected to the rod and the angular member and retains the rod and angular member against movement relative to the retainer assembly. The retainer assembly includes a retainer block into which the rod and the angular member extend. The retainer assembly is effective to hold the rod and the angular member against movement relative to the block due to force transmitted between the rod and the angular member. In one embodiment of the invention, the above-described force is transmitted between the rod and the angular member by pressing them against one another using an engagement member which, in one embodiment is a set screw.

[0004] The angular member may be provided with retaining surfaces which are engaged by mating surfaces on the block. The retaining surfaces and the mating surfaces cooperate to prevent rotational movement of the angular member about a central axis extending through the end portion of the angular member held by the block. The angular member may be formed to bend at a right angle between the block and the fastener. In one embodiment of the invention, a section of the angular member extends in a first direction parallel to the rod when the retaining surfaces and mating surfaces are engaged. In an alternate embodiment, a section of the angular member extends in a direction opposite the first direction when the retaining surfaces and mating surfaces are engaged.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] The foregoing and other features of the invention will become more apparent and the invention will

be better understood upon consideration of the following description taken in conjunction with the accompanying drawings, wherein:

[0006] Figure 1 is a dorsal view of a portion of a spinal column with a spinal column retainer according to the present invention to maintain a desired spatial relationship between vertebrae of the spinal column.

[0007] Figure 2 is a fragmentary, exploded, perspective view of a spinal column retainer according to the present invention.

[0008] Figure 3 is a fragmentary top plan view of components of a spinal column retainer according to the present invention.

[0009] Figure 4 is a side elevational view of the apparatus of Figure 3.

[0010] Figure 5 is a fragmentary perspective view of an alternate embodiment of a component of the present invention.

[0011] Figure 6 is another side elevational view of the apparatus of Figure 3.

[0012] Figure 7 is a fragmentary sectional view taken substantially along lines 7-7 of Figure 3.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0013] A portion of a human spinal column 10 to which spinal column retainer 12 is attached is illustrated in Figure 1. Spinal column retainer 12 positions vertebrae 14, 16 in a desired spatial relationship relative to one another.

[0014] Spinal column retainer 12 includes fasteners 18 made of a biocompatible material, such as stainless steel. As described in greater detail below, fasteners 18 include first threaded portions 20 (Fig. 2) which engage vertebrae 14, 16 to fixedly mount the fasteners to the vertebrae. It should be understood that multiple fasteners 18 may be secured to each vertebrae 14, 16 where multiple spinal column retainers 12 are used. Although Figure 1 shows spinal column retainer 12 configured to space two vertebrae 14, 16 relative to one another, it should be understood that many more vertebrae may be retained in spatial relationship to one another by simply increasing the length of the rod 22 extending along spinal column 10 and attaching additional connector assemblies 30 between rod 22 and the additional vertebrae.

[0015] Rod 22 is made of a biocompatible material, such as stainless steel. As indicated above, rod 22 has a length sufficient to enable the rod to span at least two vertebrae 14, 16. The required length of rod 22 depends upon the condition to be treated and the number of vertebrae to be held in a desired spatial relationship relative to one another. Rod 22 may be bent as desired, typically to establish a desired curvature of spinal column 10 in all or any of three possible anatomic planes.

[0016] Figure 1 shows two types of connector assemblies (30 and 30) for interconnecting rod 22 and fasten-

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11)

EP 0 982 007 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
01.03.2000 Bulletin 2000/09

(51) Int Cl.7: **A61B 17/70**

(21) Application number: **99306776.8**

(22) Date of filing: **26.08.1999**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE**
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **27.08.1998 US 98071 P**
16.08.1999 US 375148

(71) Applicant: **DePuy Acromed, Inc.**
Raynham, MA 02767-0350 (US)

(72) Inventor: **Krag, Martin H.**
Colchester, Vermont 05446 (US)

(74) Representative: **Belcher, Simon James**
Urquhart-Dykes & Lord
Tower House
Merrion Way
Leeds LS2 8PA (GB)

(54) **Spinal column retainer**

(57) A spinal column retainer including a rod for positioning along a spinal column, a fastener having a first portion for screwing into a portion of the spinal column and a second portion for receiving a nut, a retainer block including a passage for receiving the rod, a threaded passage for receiving a set screw, and a transverse passage, and an angular member extending between the retainer block and the fastener. The angular member

has an inner end portion captured within the retainer block, an outer end portion secured to the fastener, and a connecting portion between the end portions which forms an angular bend to offset the outer end portion from an axis of the inner end portion. The set screw forces the rod against the angular member which is forced against the retainer block, preventing movement of the components relative to one another.

EP 0 982 007 A2

may be rotated within transverse passage 52 about axis 58 to a desired position relative to block 48 and rod 22 (an example position is shown in dotted lines in Figure 6). After angular member 36 is rotated into a desired orientation about axis 58, inner end portion 38 is moved downwardly (by set screw 46 and rod 22) so that teeth 56 engage mating surfaces 54 of block 48, thereby preventing further rotation of angular member 36.

[0024] Transverse passage 52 and rod passage 50 form an intersection 82 (Fig. 7) in a central portion of block 48. Accordingly, a portion of transverse passage 52 extends into rod passage 50. In one embodiment of the invention, rod passage 50 has a central axis which is perpendicular to the central axis of transverse passage 52. In such an embodiment, when spinal column retainer 10 is assembled, axis 58 of inner end portion 38 is perpendicular to longitudinal axis 33 of rod 22 (Fig. 3). It should be understood, however, that transverse passage 52 and rod passage 50 could be formed at an acute angle relative to one another. In such a configuration, inner end portion 38 of angular member 36 would extend from block 48 at an acute angle relative to axis 33 of rod 22.

[0025] When block 48 is positioned on rod 22, the rod extends into intersection 82 (Fig. 7) between rod passage 50 and transverse passage 52. Thus, the outer side surface 84 (Figs. 4 and 7) of rod 22 may be forced against curved groove 62 of inner end portion 38 by set screw 46. Consequently, inner end portion 38 is pressed against the lower portion of block 48 by rod 22 (best shown in Figure 6). It should be understood that an intermediate force transmitting member could be positioned between outer side surface 84 and inner end portion 38. Mating surfaces 54 of block 48 (Fig. 6) are disposed on a side of transverse passage 52 opposite from intersection 82. Mating surfaces 54 extend between side walls 76 and 78 of block 48, parallel to central axis 58 of inner end portion 38. Mating surfaces 54 are formed along an arc of transverse passage 52 and extend approximately 30 degrees on each side of axis 80 of block 48. Accordingly, mating surfaces 54 have a total arcuate extent of approximately 60 degrees.

[0026] Similarly, each of teeth 56 on inner end portion 38 has a longitudinal axis which extends parallel to central axis 58 of inner end portion 38. Teeth 56 have an arcuate extent of approximately 120° about the lower outer surface of inner end portion 38. Teeth 56 may, of course, be formed such that they cover more or less than 120° of the outer surface of inner end portion 38. Since the arcuate extent of teeth 56 on inner end portion 38 is greater than the arcuate extent of mating surfaces 54 of block 48, teeth 56 can meshingly engage mating surfaces 54 when angular member 36 is in any one of a plurality of rotational orientations about axis 58 relative to block 48, as described above.

[0027] In one embodiment of the invention, angular member 36 may be provided in a "right" configuration or a "left" configuration. A "right" configuration angular

member 36 is shown in the figures. As viewed in Figure 1, angular member 36 extends to the right of block 48 (away from side 76 of block 48) and upwardly, away from side 72 of block 48. As should be apparent from the foregoing, the entire connector assembly 30 could be removed from rod 22, rotated 180°, and reinstalled on rod 22 (Fig. 3) such that angular member 36 extends to the left of block 48 (away from side 76) and downwardly, away from side 72. While the orientation of angular member 36 relative to block 48 may be rotationally adjusted somewhat about axis 58, the angular member 36 shown in Figure 3 cannot be rotated 180° about axis 58 such that it extends to the left of block 48 and upwardly into the orientation provided by a "left" configuration angular member (shown in dotted lines). As shown in Figures 6 and 7, such adjustment of "right" configuration angular member 36 is not possible because, if rotated about axis 58 180° out of the position shown in Figures 6 and 7, teeth 56 of angular member 36 would face upwardly toward rod 22 and groove 62 would face downwardly toward mating surfaces 54 of block 48. Accordingly, rod 22 and groove 62 could not cooperate to fix the position of angular member 36 along axis 58 relative to block 48, and teeth 56 and mating surfaces 54 could not cooperate to fix the orientation of angular member 36 about axis 58 relative to block 48. Thus, a "left" configuration angular member according to the present invention includes an inner end portion 38 identical to that shown in the figures, but extends away from side 76 of block 48 and upwardly, away from side 70 when block 48 is fastened to rod 22 in the orientation shown in Figure 3.

[0028] A universal angular member 36 could readily be made by, for example, forming groove 62 around the entire circumference of inner end portion 38 and forming teeth 56 on the remainder of the surface of inner end portion 38 not occupied by groove 62. Although the meshing surface area between teeth 56 and mating surfaces 54 would be reduced, such a retainer member 36 could be adjusted to any one of a plurality of angular orientations within a 360° range of adjustment about axis 58. Alternatively, the arcuate extent of teeth 56 could be reduced from 360° and the arcuate extent of mating surfaces 54 could be increased such that a sufficient number of teeth 56 engage a sufficient number of mating surfaces 54 at any one of a plurality of angular orientations within a 360 range of adjustment about axis 58.

[0029] In one embodiment of the invention, outer end portion 42 of angular member 36 is generally cylindrical in shape and includes a bore 86. Bore 86 has a central axis 88 which is perpendicular to central axis 58 of inner end portion 38 (Fig. 2). Fastener 18 is received by bore 86. When angular member 36 is secured to fastener 18 as described below, central axis 88 of bore 86 may be coincident with a central axis of fastener 18. Thus, fastener 18 may extend in a direction perpendicular to central axis 58 of inner end portion 38. However, as best shown in Figure 3, central axis 88 of bore 86 is offset a

ers 18. The lower connector assembly 30 is of the kind described and shown in U.S. Patent No. 5,741,255. As fully explained in U.S. Patent No. 5,741,255, connector assembly 30 includes a transverse member 32 which extends between fastener 18 and rod 22 in perpendicular relationship to a longitudinal axis 33 of rod 22. The connector assembly 30 of the present invention (the upper connector assembly shown in Figure 1) generally includes a retainer assembly 34 which is mounted on rod 22, and an angular member 36 which extends between fastener 18 and retainer assembly 34. Retainer assembly 34 fixes the position of a generally cylindrical inner end portion 38 of angular member 36 relative to retainer assembly 34. A clamp assembly 40 fixedly connects an outer end portion 42 of the angular member 36 to fastener 18. In one embodiment of the invention, a connecting portion 44 forms a right angle bend between inner end portion 38 and outer end portion 42 of angular member 36.

[0017] Referring now to Figure 2, retainer assembly 34 includes a set screw 46 and a generally rectangular retainer block 48 into which angular member 36 and rod 22 extend. Block 48 has a rod passage 50 which receives rod 22. Rod 22 is shown having a substantially circular cross-section; however, rods having various other cross-sections, such as hexagonal or oval cross-sections, could be used with corresponding modifications to rod passage 50. Block 48 also includes a transverse passage 52 which receives inner end portion 38 of angular member 36 and communicates with rod passage 50. As best shown in Figure 6, transverse passage 52 includes a plurality of mating surfaces 54 which engage similarly shaped retaining surfaces or teeth 56 that project radially outwardly from inner end portion 38 of angular member 36. Meshing engagement between mating surfaces 54 on block 48 and teeth 56 on inner end portion 38 prevents rotational movement of angular member 36 about a longitudinal central axis 58 of inner end portion 38. It is understood that mating surfaces of various shapes may be formed in transverse passage 52 to receive similarly shaped retaining surfaces formed on block 48. For example, the triangular teeth shown in Figure 6 may be replaced with rectangular ridges and mating channels or curved protrusions and mating grooves.

[0018] As best shown in Figure 7, force is transmitted between rod 22 and angular member 36 by set screw 46 to hold rod 22 and angular member 36 against movement relative to block 48. Set screw 46 is tightened into threaded set screw passage 60 which is formed in block 48 and communicates with rod passage 50. Set screw 46 moves downwardly into engagement with rod 22, thereby forcing rod 22 downwardly against inner end portion 38 of angular member 36. Specifically, rod 22 is urged downwardly into a saddle-shaped groove 62 which extends partially around the circumference of inner end portion 38. Groove 62 is formed to receive the curved outer surface 84 of rod 22. The force transmitted

by rod 22 presses teeth 56 of inner end portion 38 into meshing engagement with mating surfaces 54 of the lower portion of transverse passage 52 (Fig. 6). Accordingly, engagement between the outer surface 84 of rod 22 and groove 62 of inner end portion 38 retains inner end portion 38 against movement relative to block 48 about central axis 58 and retains rod 22 against movement relative to block 48 along longitudinal axis 33.

[0019] Inner end portion 38 of angular member 36 further includes an annular lip 64 and a circumferential groove 66 formed, for example, by a swaging operation. Annular lip 64 is formed such that its outer diameter is larger than an inner diameter of transverse passage 52 (Fig. 6). Accordingly, angular member 36 is retained within retainer assembly 34 even when rod 22 is removed or raised upwardly within rod passage 50. Additionally, one end of transverse passage 52 includes a beveled edge 68 (Fig. 7) which permits partial recess of annular lip 64 within transverse passage 52.

[0020] Referring now to Figures 2-4, block 48 has a pair of parallel, flat side surfaces 70, 72. Rod passage 50 extends between and is perpendicular to side surfaces 70, 72. Block 48 also includes a pair of parallel side surfaces 76, 78 which extend perpendicular to side surfaces 70, 72 (Fig. 3). Transverse passage 52 has a straight longitudinal central axis which extends between and is perpendicular to side surfaces 76, 78.

[0021] Rod passage 50 is formed by a pair of circular openings 81, 83 having centers which are offset along an axis 80 (Figs. 2, 4, and 7) of block 48. As a result, rod passage 50 has a generally oval cross-sectional configuration. In one embodiment of the present invention, axis 80 is substantially centered between sides 70, 72, but is closer to side 76 than side 78 of block 48. Circular openings 81, 83 which form rod passage 50 are sized such that rod 22 can move between the upper and lower portion of rod passage 50 when set screw 46 is backed out of set screw passage 60. Accordingly, block 48 may be positioned along the length of rod 22. As best shown in Figure 7, upper circular opening 83 is larger than the diameter of rod 22 so that rod 22 can move freely within opening 83. Lower circular opening 81 of rod passage 50 has a diameter which is smaller than the diameter of rod 22. Thus, rod 22 and rod passage 50 have an interference fit when rod 22 is urged into lower circular opening 81 by set screw 46.

[0022] As best shown in Figure 6, transverse passage 52, like rod passage 50, has a generally oval cross-section which is elongated in the direction of axis 80 of block 48. The oval configuration of transverse passage 52 enables movement of inner end portion 38 of angular member 36 upwardly and downwardly along central axis 80 when set screw 46 is backed out of set screw passage 60.

[0023] The orientation of angular member 36 relative to block 48 may be adjusted by moving end portion 38 upwardly within transverse passage 52 to space teeth 56 from mating surfaces 54 so that inner end portion 38

5. A spinal column retainer 12 according to claim 1 wherein the second passage 52 extends through the block 48 at a right angle relative to the first passage 50.
6. A spinal column retainer 12 according to claim 1 wherein the first end portion 38 of the angular member 36 includes a groove 62 for receiving the rod 22, the first passage 50 extending through a first side 70 and a second side 72 of the block 48, the second passage 52 extending through a third side 76 and a fourth side 78 of the block 48.
7. A spinal column retainer 12 according to claim 6 wherein the first end portion 38 of the angular member 36 is substantially cylindrical, having a plurality of retaining surfaces 56 projecting radially outwardly relative to the central axis 58, the plurality of retaining surfaces 56 being disposed on an outer surface of the first end portion 38 substantially opposite the groove 62, the second passage 52 of the block 48 including a plurality of mating surfaces 54 for receiving the plurality of retaining surfaces 56 when the rod 22 engages the angular member 36, thereby preventing rotational movement of the angular member 36 about the central axis 58.
8. A spinal column retainer 12 according to claim 7 further comprising a first section 45 extending between the first end portion 38 and the angular bend 47 and a third section 49 extending between the angular bend 47 and the second end portion 42.
9. A spinal column retainer 12 according to claim 8 wherein the first section 45 extends from the first end portion 38 away from the third side 76 of the block 48 and the third section 49 extends from the second section 47 away from the first side 70 of the block 48 when the plurality of mating surfaces 54 receive the plurality of retaining surfaces 56.
10. A spinal column retainer according to claim 8 wherein the first section 45 extends from the first end portion 38 away from the third side 76 of the block 48 and the third section 49 extends from the second section 47 away from the second side 72 of the block 48 when the plurality of mating surfaces 54 receive the plurality of retaining surfaces 56.
11. A spinal column retainer 12 according to claim 1 wherein the first end portion 38 of the angular member 36 includes a plurality of outwardly projecting retaining surfaces 56, the second passage 52 of the block 48 including a plurality of mating surfaces 54 for receiving the plurality of retaining surfaces 56 when the rod 22 engages the angular member 36, thereby preventing movement of the angular member 36 about the central axis 58.
12. A spinal column retainer 12 according to claim 1 wherein the first end portion 38 of the angular member 36 is substantially cylindrical and includes an annular lip 64 at an end opposite the angular bend 47 to retain the angular member 36 within the block 48, the annular lip 64 having an outer diameter larger than an inner diameter of the second passage 52.
13. A spinal column retainer 12 according to claim 12 wherein the second passage 52 includes a beveled edge 68, the annular lip 64 being at least partially recessed in the second passage 52 by the beveled edge 68.
14. A spinal column retainer 12 according to claim 1 wherein the second end portion 42 includes an opening 86 for receiving a portion 92 of the fastener 18.
15. A spinal column retainer 12 according to claim 14 wherein the opening 86 is a bore.
16. A spinal column retainer 12 according to claim 14 wherein the opening 86 is a slot.
17. A spinal column retainer 12 according to claim 1 further comprising a third passage 60 which extends into the block 48 in communication with the first passage 50, and an engagement member 46 which is received by the third passage 60 and engages the rod 22 to cause the rod 22 to engage the angular member 36.
18. A spinal column retainer 12 according to claim 17 wherein the third passage 60 is threaded and the engagement member 46 is a set screw.
19. A spinal column retainer 12 for implantation into a patient to retain portions of a spinal column 10 in a desired spatial relationship relative to one another, comprising:
 - a rod 22;
 - a fastener 18 having a first threaded portion 20 for screwing into a portion of the spinal column 10 and a second portion 92;
 - a block 48 including a first passage 50 for receiving the rod 22 and a second passage 52 in communication with the first passage 50; and
 - an angular member 36 including a first end portion 38 extending into the second passage 52 and having a central axis 58, a second end portion 42 for connecting to the second portion 92 of the fastener 18, the fastener 18 being secured to the second end portion 42, and a connecting portion 44 having a first section 45 extending from the first end portion 38 away from the block 48 along the central axis 58, a second

distance from central axis 58 and a distance from axis 33 of rod 22.

[0030] Referring now to Figure 2, a clamp assembly 40 is formed by a threaded outer end portion 92 of fastener 18, an internally threaded nut 94, a hexagonal shoulder 96 formed on fastener 18, and a hexagonal outer end portion 98. By simultaneously engaging hexagonal outer end portion 98 and nut 94 with wrenches, nut 94 may be firmly tightened onto threaded portion 92 of fastener 18 without transmitting force to threaded portion 20 of fastener 18. When nut 94 is tightened, it engages the upper end surface 100 of outer end portion 42, and shoulder 96 engages the lower end surface 102 of outer end portion 42. Consequently, outer end portion 42 is held fixed relative to fastener 18 by clamp assembly 40.

[0031] Figure 5 shows an alternate embodiment of outer end portion 42 of angular member 36 (designated 42). Outer end portion 42 includes a slot 86 instead of bore 86. Slot 86 is, in this embodiment, elongated in a direction substantially perpendicular to central axis 58 of inner end portion 38 and has a central axis 88 which is substantially perpendicular to axis 58. Outer end portion 42 otherwise cooperates with fastener 18 in the manner described above. As should be apparent from the foregoing, the elongated configuration of slot 86 permits adjustment of the distance between fastener 18 and axis 58.

[0032] Connecting portion 44 of angular member 36 extends between inner end portion 38 and outer end portion 42. Connecting portion includes a first section 45 which extends from inner end portion 38, a second section 47 which extends from first section 45, and a third section 49 which extends between second section 47 and outer end portion 42. In one embodiment, connecting portion 44 is tubular or bar-shaped and first, second, and third portions 45, 47, 49 and substantially planar. First section 45 extends away from block 48 and is centered on axis 58 (Fig. 3). Second section 47 forms an angular bend or elbow away from axis 58. In the embodiment illustrated, the angular bend of second section 47 is 90°. Alternatively, the angular bend could provide a different angle relative to axis 58, such as a 45° angle. Third section 49 extends along an axis 51 at the angle relative to axis 58 established by second section 47, and connects to outer end portion 42. It should be understood that outer end portion 42 need not be planar relative to connecting portion 44, but rather may extend at an angle relative to a plane intersecting first, second, and third sections 45, 47, 49 of connecting portion 44.

[0033] The direction of the angular bend of second section 47 determines whether angular member 36 is a "right" or "left" configuration angular member. As shown in Figure 1, the angular bend provided by connecting portion 44 permits attachment of connector assembly 30 to a vertebra having a portion 16 which would otherwise interfere with a laterally extending transverse member 32 of a connector assembly 30 (the lower con-

necter assembly). Additionally, where multiple spinal column retainers 12 are used on a single spinal column 10, interference between adjacent connector assemblies 30 may be avoided by the offset location of fastener 18 provided by the angular bend of connecting portion 44.

[0034] While this invention has been described as having exemplary embodiments, this application is intended to cover any variations, uses, or adaptations using its general principles. Further, this application is intended to cover such departures from the present disclosure as come within the known or customary practice within the art to which it pertains. The spirit and scope of the invention are to be limited only by the terms of the appended claims.

Claims

1. A spinal column retainer 12 for implantation into a patient to retain portions of a spinal column 10 in a desired spatial relationship relative to one another, comprising:
 - a rod 22;
 - a fastener 18 having a first threaded portion 20 for screwing into a portion of the spinal column 10;
 - a block 48 including a first passage 50 for receiving the rod 22 and a second passage 52 in communication with the first passage 50; and
 - an angular member 36 including a first end portion 38 extending into the second passage 52 and having a central axis 58, a second end portion 42 for connecting to the fastener 18, and an angular bend 47 between the first end portion 38 and the second end portion 42, the angular bend spacing the second end portion from the block 48 and the central axis 58;
 - the rod 22 being secured to the block 48 and engaging the angular member 36 to prevent movement of the angular member 36 relative to the block 48.
2. A spinal column retainer 12 according to claim 1 wherein the angular bend is a right angle.
3. A spinal column retainer 12 according to claim 1 further comprising a first section 45 extending between the first end portion 38 and the angular bend 47 and a third section 49 extending between the angular bend 47 and the second end portion 42.
4. A spinal column retainer 12 according to claim 3 wherein the third section 49 has a central axis 51 which is substantially parallel to a longitudinal axis 33 of the rod 22.

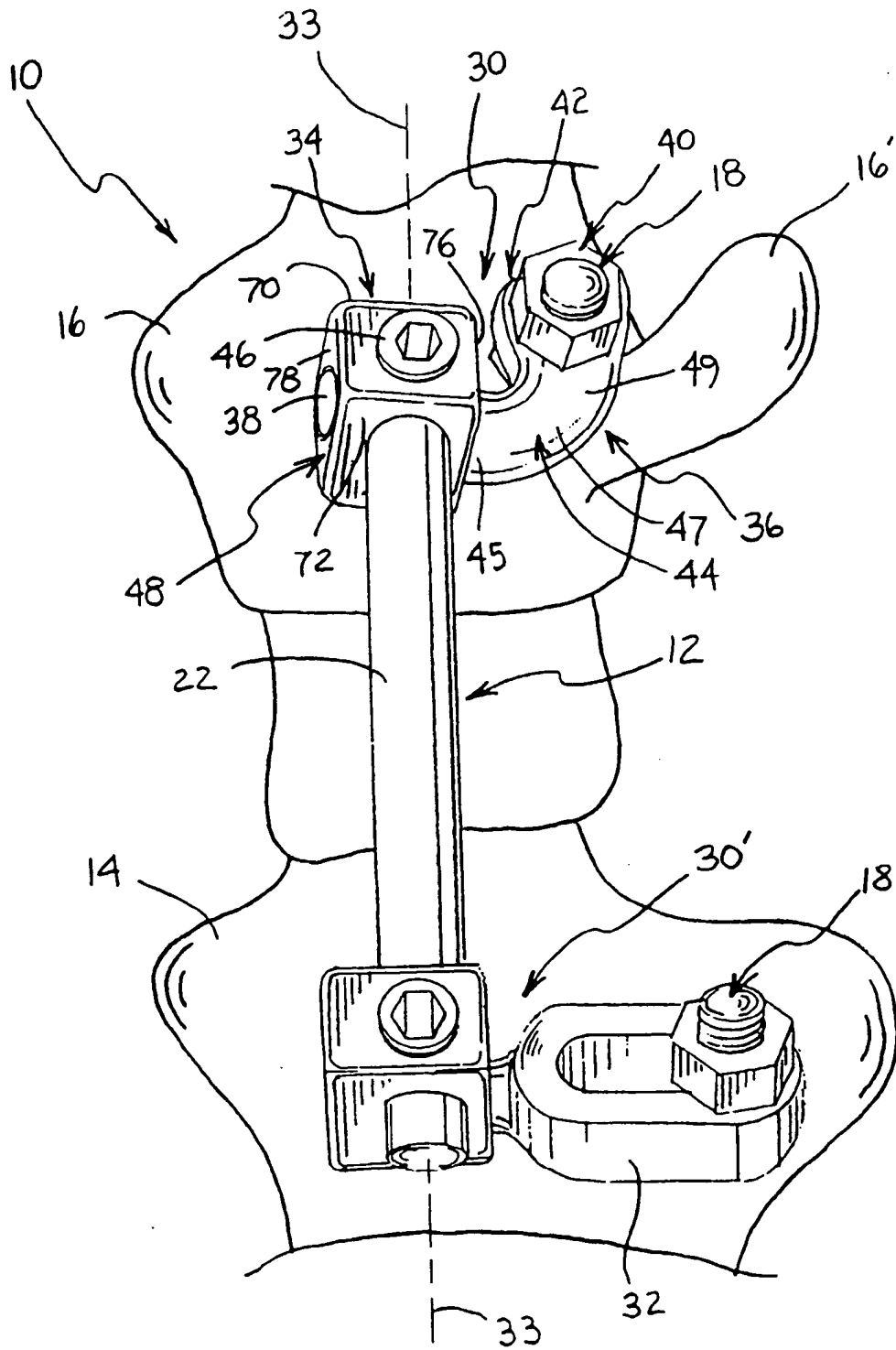


FIG. 1

section 47 extending from the first section 45 forming an angular bend away from the central axis 58, and a third section 49 extending between the second section 47 and the second end portion 42 at an angle relative to the central axis 58;

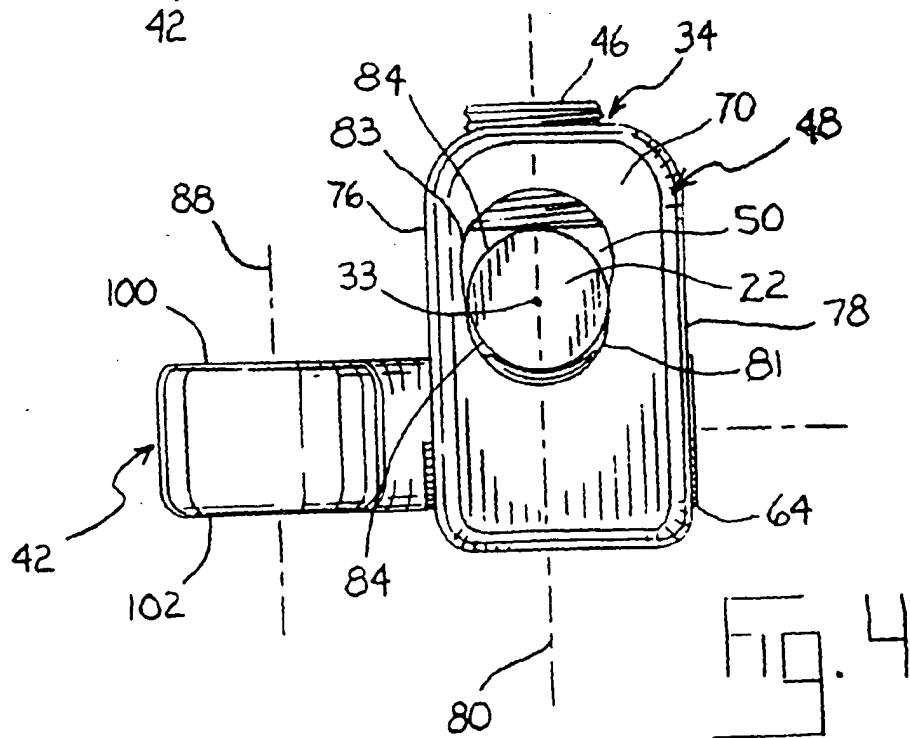
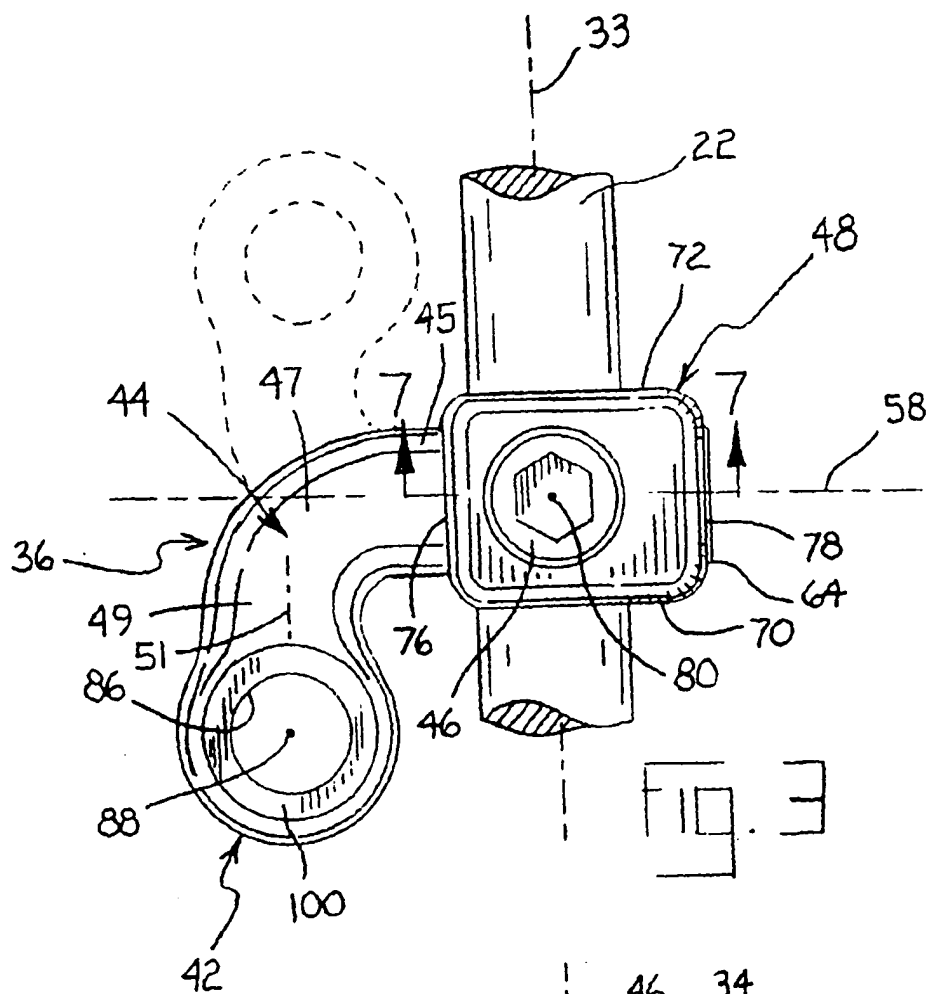
the rod 22 being secured to the block 48 and engaging the angular member 36 to prevent movement of the angular member 36 relative to the block 48.

20. A spinal column retainer 12 for implantation into a patient to retain portions of a spinal column 10 in a desired spatial relationship relative to one another, comprising:

a rod 22;
a fastener 18 having a first threaded portion 20 for screwing into a portion of the spinal column 10 and a second portion 92;
a block 48 including a first passage 50 for receiving the rod 22, a second passage 60, and a third passage 52, the second passage 60 and third passage 52 being in communication with the first passage 50;
an angular member 36 including a first end portion 38 extending into the third passage 52 and having a central axis 58, a second end portion 42 having an opening 86 for receiving the second portion 92 of the fastener 18, the fastener 18 being secured to the second end portion 42, and a connecting portion 44 having a first section 45 extending from the first end portion 38 away from the block 48 along the central axis 58, a second section 47 extending from the first section 45 forming an angular bend away from the central axis 58, and a third section 49 extending between the second section 47 and the second end portion 42 at an angle relative to the central axis 58; and
an engagement member 46 for extending into the second passage 60 to engage the rod 22, thereby preventing movement of the rod 22 relative to the block 48 and causing the rod 22 to engage the angular member 36 to prevent movement of the angular member 36 relative to the block 48.

50

55



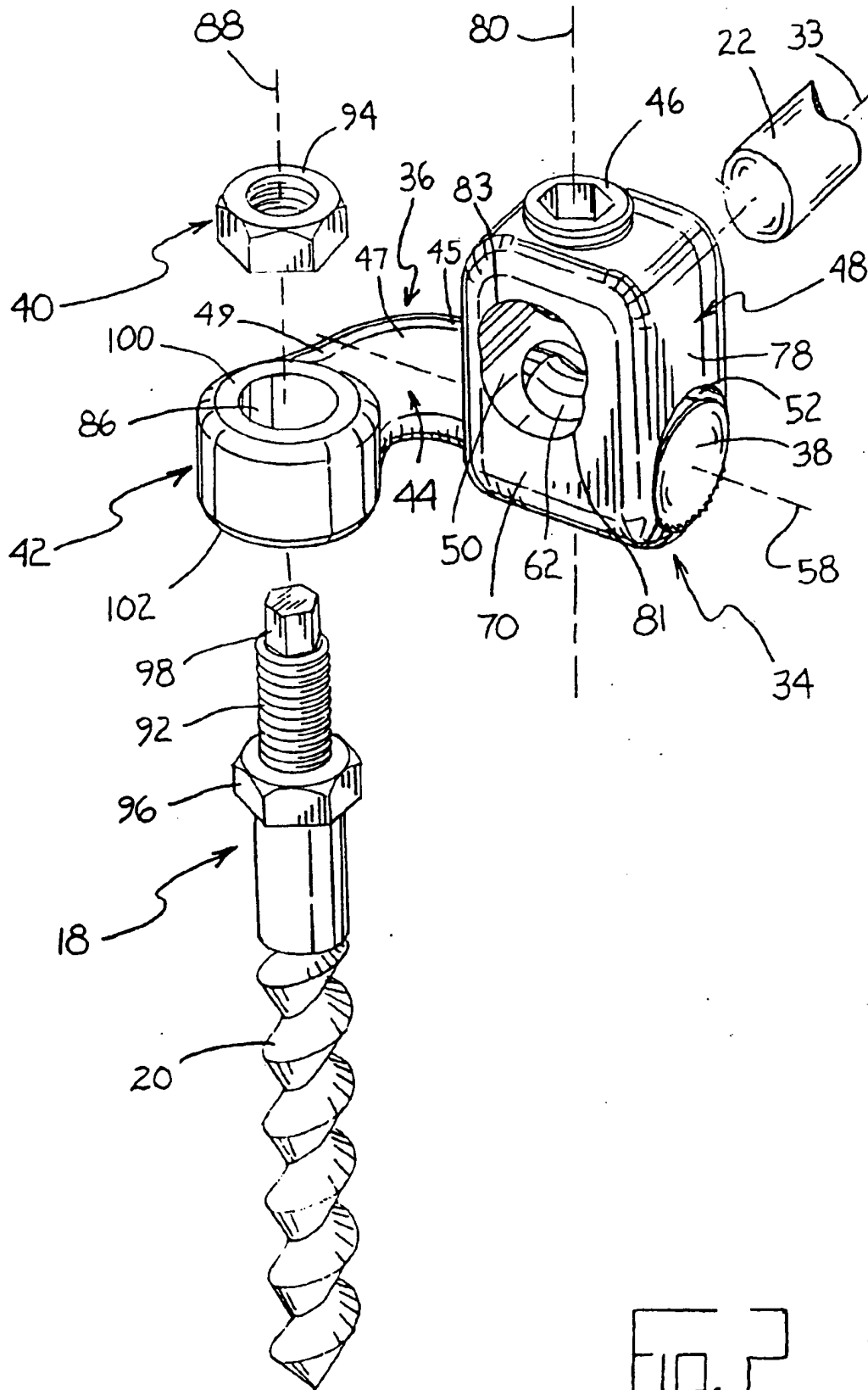
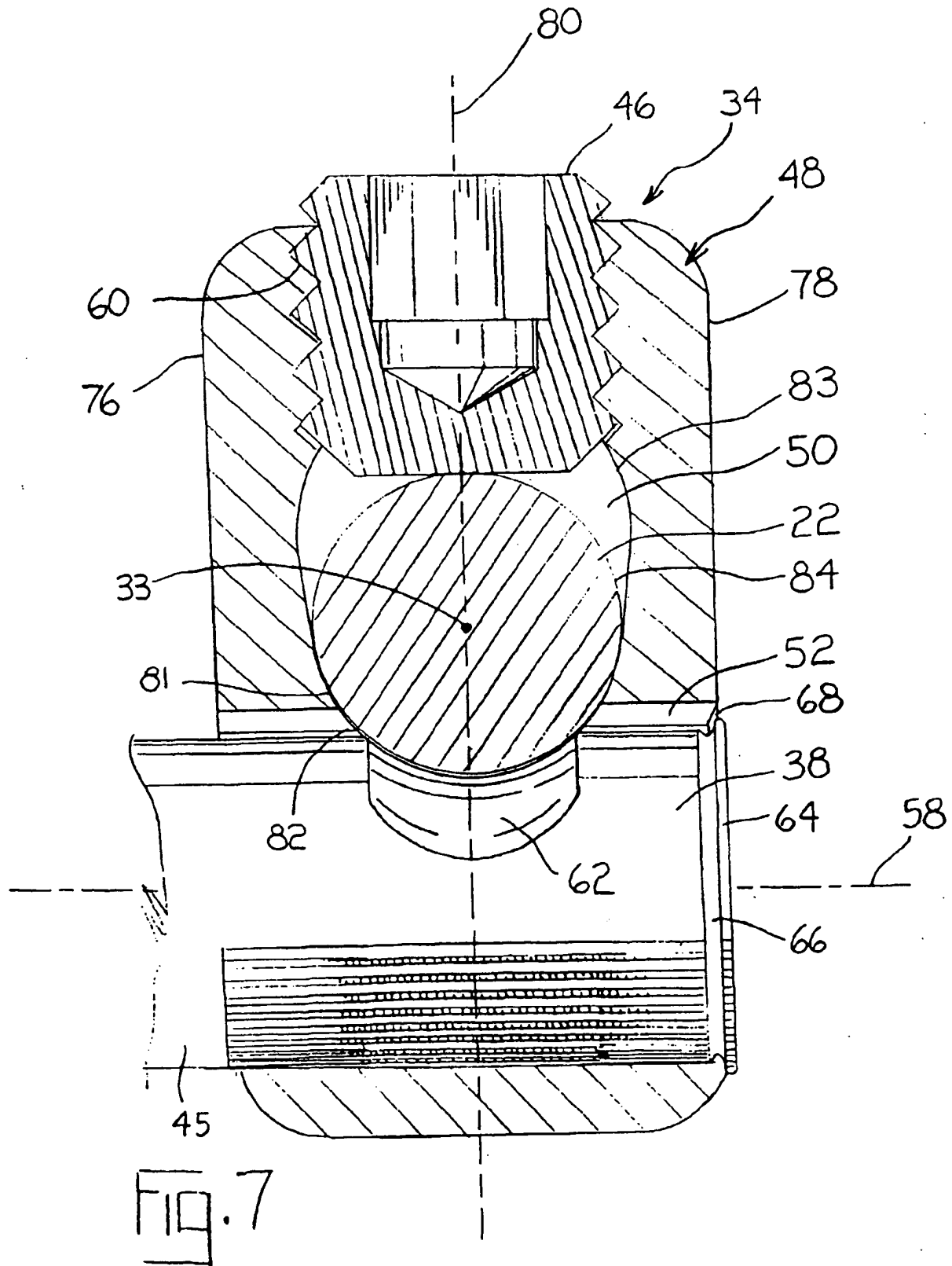


Fig. 2



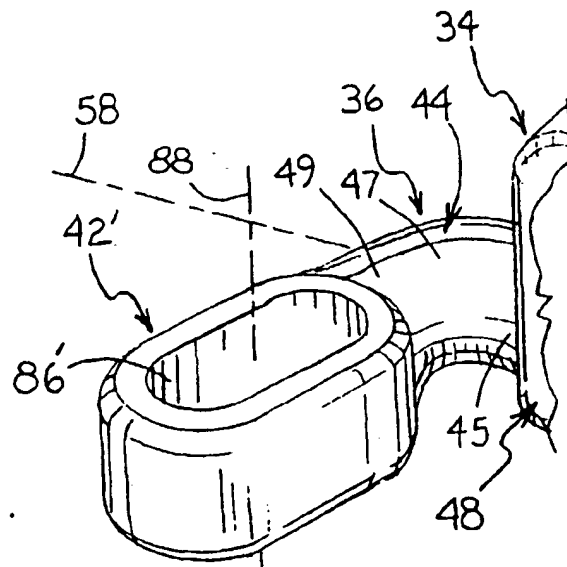


FIG 5

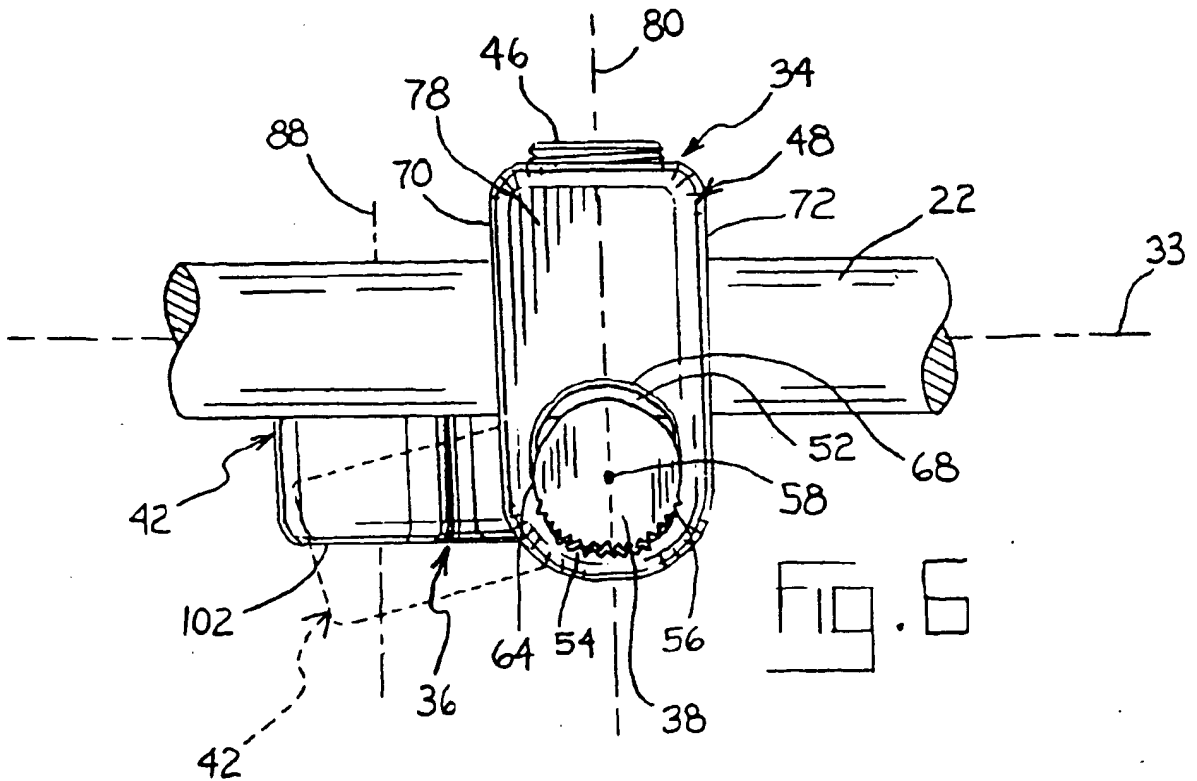


FIG. 6